and origin of mountain chains, English geologists were conspicuous not only by the clearness of their views but by the skilful manner in which they applied the new principles to the explanation of our own mountain masses, especially those of the Scottish Highlands. Daniel Sharpe demonstrated the essential points of resemblance between the structure of the mountains of Scotland and those of Southern Europe; while Scrope and Darwin went still further in insisting that the intimate structure or foliation of the rock-masses of our own and other mountain chains must be attributed to the mechanical effects of the great movements to which they have been subjected. Unfortunately the great influence of Murchison, backed as it was by the authority of the officers of the Geological Survey, threw back the advance of English geology in this direction for nearly a quarter of a century. The doctrines that the rocks of the Highlands were in an essentially undisturbed condition, and that in them the planes of stratification and foliation were coincident, were backed by such a weight of authority, that for a time they overbore all opposition. To the labours of Prof. Lapworth we are indebted for initiating the great reaction against the mischievous teachings of this school; while Messrs. Peach and Horne have more than atoned for the evil done by their predecessors, by the energy and zeal with which they have sought to neutralize the effects of those teachings. It is a fortunate circumstance that these patient researches have been carried on in the very districts which had been appealed to as affording the strongest support to the erroneous interpretations.

In the second section of the work before us the various terms employed by Rogers and the American geologists, by Lory, Baltzer, Heim, Suess, Brögger, Reusch, and other Continental writers, as well as by Lapworth, Geikie, Peach, and Horne, are all brought into clear relation with one another. Where necessary the complicated effects of great mountain movements are illustrated by sketches, and the most invaluable aid is thus afforded to the student who seeks to make himself acquainted with and to compare the remarkable results attained by the workers in distant areas. Especially interesting are the observations upon the intricate phenomena displayed in cases where rocks that have been sheared and foliated during one period of mountain-making are subjected to a second process of the same kind at a long subsequent period. We regret that the space at our command forbids us from following the authors into some of these interesting questions.

The important problems connected with the changes in the internal structure of rocks resulting from the movements to which they have been subjected occupy the authors only so far as is necessary to fix the terms that shall be employed in describing the effects produced. The relative merits of such terms as "pressure metamorphism," proposed by Prof. Bonney; of "pressure-fluxion," by the late Prof. Carvill Lewis; of "dislocations-metamorphism," by Prof. Lossen; of "mechanical metamorphism," by Baltzer; of "metamorphism by friction," by Gosselet; and finally, of "dynamo-metamorphism," recently suggested by Prof. Rosenbusch, are all impartially considered. Whatever be the term eventually chosen to express the important effects produced by the internal movements—the "flowing"—of rock-masses, we can only rejoice that the ideas so ably advocated long ago by Scrope and Darwin are now beginning to meet with such wide and general recognition. Problems which in the days of these pioneers of geological thought were absolutely insoluble are now brought within the range of practical research. Lehmann, Lossen, and a host of other workers are showing us how by the application of microscopic methods the paramorphic changes and the mutual chemical reactions of minerals in a rock subjected to external stresses and internal movements may be clearly followed step by step; while the physical investigations of Daubrée, Tresca, and Spring afford to us the promise that the actual causes of the phenomena so carefully observed will not long remain hidden from our view.

The numerous workers in all the great centres of thought, whose attention and study are now concentrated upon these grand and fascinating problems, will welcome the work before us as supplying a want that has been widely and deeply felt. JOHN W. JUDD.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*]

Lamarckism *versus* Darwinism.

IN his first letter Dr. Romanes stated that I had accused him without evidence. In the second letter he repeats the statement in other words. The answer to both statements will be found in my last letter.

Dr. Romanes will not have replied to my first letter until he explains or expresses regret for his unfairness to Dr. Weismann.

Oxford, September 3. EDWARD B. POULTON.

The Zodiacal Light and Meteors.

I HAVE had the opportunity of looking at Mr. Maxwell Hall's letter (NATURE, vol. vii. p. 204), referred to by Mr. Mattieu Williams (May 31, p. 102), and find that it will not in the least bear out the suggestion made by the latter. Hall's observation was evidently not of any "spurious zodiacal light," but of the ordinary zodiacal light in the form called by some writers the "zodiacal band," though perhaps especially bright. Its position, also, as observed by Hall, was quite different from that which could be occupied by a stream of meteors from Biela's comet.

As regards Hall's theory, which he there propounds for the form of the zodiacal light, it has not met with acceptance, as writers in general consider the ordinary theory of the zodiacal light, viz. that it consists of a continuous disk, whether of meteors or any other substance, in which the sun is central, is sufficient to account for the appearances described by Maxwell Hall and other observers. T. W. BACKHOUSE.

Sunderland, August 31.

THE SERVICES OF CATHOLIC MISSIONARIES IN THE EAST TO NATURAL SCIENCE.

M. ARMAND DAVID, the well-known Lazarist missionary and man of science, has published a series of articles in the recent numbers of *Les Missions Catholiques* of Lyons on the services rendered to the natural sciences by the missionaries in the Far East. The following is a summary of these long and instructive articles.

It is a common mistake that Catholic missionaries are engaged in proselytizing, and in proselytizing only. Undoubtedly the original motive has been to convert pagan nations to Christianity ; but, as will be shown, they have worked in other channels with very great success. Accounts of scientific work like that of the writer are not common, because the missionaries are so few that they have very little time to devote to anything outside their religious duties. The advantages of missionaries preceding the ordinary travellers are well known, and have been recognized by various learned Societies. It is, however, of Eastern Asia in particular of which M. David proposes to treat—that is, of China, which contains a third part of the population of the earth, and which is attracting more and more attention every day. The enemies of the Catholic clergy compare the present missionaries in China very unfavourably with the Jesuits who shone at Pekin in the seventeenth and eighteenth centuries. It is undoubted that the Jesuit fathers of Pekin bore an exceedingly high reputation in science and art, and that they produced very considerable results in almost every branch of human knowledge. They completed the most colossal geographical work that has ever yet been seen, by making a complete chart of the Chinese Empire. The "Lettres Édifiantes," the "Mémoires des Missionaires Jésuites de Pékin," the great works of Father Duhalde and of Father de Mailla show the immense mass of matter they have written upon almost every subject relating to the Chinese Empire. But, it is asked, why speak of the great achievements of the past ? They only accentuate the total absence of any scientific labours at the present time in China. M. David has several answers to this question. (1) Formerly the Academies and learned Societies of Europe could communicate only with the missionaries on questions relating to China ; no other travellers had then found their way into the Celestial Empire ; and it was to aid this communication that the Catholic kings helped the missionaries with their protection and their money, as well as from religious motives. (2) The missionaries knew that they were compelled, in order to get permission to remain in China, to make their services indispensable to the emperor ; and thus they put all their knowledge and skill at his service. (3) Whilst only a small number of missionaries thus resided at Pekin, and gained and kept the confidence of the emperor by their pursuit of astronomy, geography, and the arts, the rest, by the favour in which their brethren stood, got permission to preach throughout China.

St. Francis Xavier, the apostle of India, died without being able to enter China. Father Riccí, who entered it in 1580, led to Pekin quite a phalanx of eminent men, to occupy the posts of honour near the emperor. These high positions did not, however, prevent the missionaries from labouring in the cause of Christianity, and founding many Christian establishments. Amongst them were the Fathers Verbiest, Schall, de Premare, Gaubel, Amyot, and many others. The suppression of the Jesuit order stopped their work in China, and the Lazarists, who were sent to succeed them, and who had in their ranks men like MM. Raux, Ghislain, Hanna, and Lamiot, were themselves soon swept away by a revolution. The persecution soon became general in China, and some priests who were able to elude the edicts and remain in the country at the cost, very often, of their lives, were fully occupied without attending to scientific studies. The same was the case with their immediate successors, who were sent by various Societies to collect and strengthen the scattered congregations. Afterwards when the Anglo-French expedition procured freedom of conscience for the Christians and liberty for the missionaries to remain in China, things were very different from what they had been under the Emperors Kang-hi and Kien-lung. The thread of the scientific labours of the old fathers at Pekin could not be picked up. For, on the one hand, China was now in communication with the rest of the world, and had not the need nor the desire to have recourse to the missions for their learned and scientific men ; and, on the other hand, the Christian missionaries and their flocks now enjoyed toleration, and the priests had nothing to gain by imitating their great predecessors in gaining the favour of the emperor. Besides, European diplomatists did not look with a favourable eye on the influence that would be acquired by priests over the emperor if they accepted official posts. The Jesuit fathers, however, who had returned to China when their suppression had been annulled, did not completely separate themselves from their former studies, but continued them as far as their changed condition would allow. For example, in their college of Zikawei, near Shanghai, they succeeded in establishing a very important meteorological observatory, whence Father Dechevrens regularly sends his observations to the men of science all over the world ; natural history owes much to the persevering labours of Father Heude, who has published a work on the "Mollusques fluviatiles et terrestres" of Central China, and others on the stags and tortoises of China. The able draughtsman, Father Rhatouis, helped Father Heude by drawing the excellent illustrations of these books, some of which were printed in the Jesuit establishment in China. In other parts of the country, many of these missionaries give themselves up to forming and sending to our Museums collections of plants and animals. At Kwei-chow, Abbé Perny, of the Foreign Missions, put together a very interesting collection of plants, which, with other articles of value, he has presented to the Jardin des Plantes. He introduced into France the great silk-worm that bears his name (*Attacus pernyi*), and which already is reared in the open air on the oak-trees of the more temperate regions of France. On his return from China, Abbé Perny published a Chinese grammar and vocabulary, and many works on the productions of the Far East. From Tibet, Mgr. Chauveau and his successor, Mgr. Biet, and above all M. Desgodins, have sent to Europe many precious documents and several collections of animals, which give us an idea of the physical condition of that almost impenetrable region. M. Furet in Japan, M. Larnaudie in Siam, M. Pourthié in Corea, and M. Bon in Tonquin, and several others, have all in the respective countries of their adoption studied the geography and the natural history, and have sent their scientific collections to enrich our public and private establishments. At Yun-nan, M. Delavay, of the Foreign Missions, has given up for many years all his available time to the study of the plants of this unexplored province with the most remarkable zeal and success. The plants which he has already sent to the French Museum are the most important that have ever been sent from China to Europe, and botanists are surprised at the number of new species they contain. An account of these new species has been prepared by M. Frauchet, and will shortly be published in a big octavo volume. M. David prides himself on being the cause of M. Delavay following these botanical pursuits which have so enriched science. They met accidentally at Hong-Kong, and after some trouble M. David succeeded in inducing him to become a correspondent of the Jardin des Plantes. The Professors of that establishment have been so satisfied with the labours of M. Delavay that they have sent him one of their decorations with several money grants to help him to continue his fruitful researches. A few facts will show the value of the labours of this gentleman. Formerly only four or five Chinese representatives of the class *Rhododendron* were known, but the new species found by M. Delavay, added to those found by M. David at Moupinn, amount to forty-five. So, only one Chinese primrose was known, but now more than thirty new species have been classified by M. Delavay. Other missionaries besides those of China are actively engaged in the cause of science; for example, Father Montrouzier has studied the fauna of several of the islands of Oceania, and Fathers Duparquet, Augouard, and Le Roy, have sent from Africa many valuable collections. Our Museums and our naturalists have also received from the interior of America many objects more or less important, but chiefly many remarkable Coleoptera and Lepidoptera from MM. Sipolis, Gaujon, and Dorme, French Lazarists, who are quite at the head of the ardent collectors in the New World. To return to China, through the good offices of the Franciscan missionaries of Shen-si, M. Romanet du Cailland was able to obtain and introduce to France several new species of vine which have been cultivated under the names *Vitis Romaneti*, *Vitis Pagnuccii*, *Spinovitis Davidis*. This last species was found by M. David in a wild state in the central mountains of Tsin-lin, and is notable for having its stems covered with thorns. In spite of its somewhat aromatic flavour, it is well adapted for wine-making.

M. David then proceeds to particularize his own labours, and before doing so he gives a short history of his life, into which we shall not follow him. Shortly after the Anglo-French expedition to China he was ordered by his superiors to proceed to that country. Before setting out he was advised by several members of the Institute, amongst them being MM. Stanislas Julien, E. Milne-Edwards, Élie de Beaumont, and Decaisne, to make periodical reports. When he had settled down at Pekin in the year 1862, he began to explore the surroundings of Pekin to prepare materials for a natural history collection, and to send reports and specimens to the Jardin des Plantes. His first consignment of plants and animals was highly praised by the authorities of this institution, and grants of money were sent him to help him to proceed. The increasing importance of the results obtained in China made the Professors of the Museum believe that it was an Eldorado for naturalists, and accordingly they begged the Superior-General of the Lazarists to permit M. David to explore the lesser-known provinces of China. M. Etienne consented readily, chiefly because the request was made through the Government itself; and the Minister of Public Instruction officially styled M. David's proposed journey a scientific mission, and supplied the necessary funds. With regard to the collections sent home by him, he says that only zoologists can appreciate the great work of M. Milne-Edwards, entitled "Recherches sur les Mammifères," which, with the exception of a single species, treats of Chinese animals. The greater portion of these were sent by M. David, the new species alone amounting to sixty-five. One of the most remarkable of these is the *Semnopithecus roxellana*, a curious monkey with a nose very much turned up and a green face, with his back ornamented with long brown and white hair, whose haunts are in the cold forests of Tibet. It is a sort of counterpart of the long-nosed monkeys of Borneo. Besides this animal, China supplied two others, one of which was capable of bearing the severe winters of the north of Tchely, to which point its habitat extends. Another important discovery of the Tibetan region is the extraordinary *Ursus melanoleucus*, for which there was no generic name. The *Ailuropus melanoleucus* appears to be of great rarity in the very small region it inhabits. All the Museums of the world envy the Jardin des Plantes the possession of four specimens—the only ones M. David met. In Tibet also he saw the *Nectogale elegans*, a new kind of aquatic insectivorous animal, the hair of which assumes all the colours of the rainbow when the little creature is in the water. He also secured several varieties of this animal. In the lofty forests of Moupinn he found the *Budorcas*, a large ruminant of a grayish-white colour, with no tail and with immense horns. The hunters of the country regard this animal as the tiger is regarded in India. In spite of its heavy build it scrambles over the most rugged rocks as lightly as a chamois. In almost every district in China he came on some treasure. The deer with large hoofs and a long tail (*Elaphurus davidianus*) is now pretty well known; but the species is, unfortunately, threatened with extinction in China. In the genus *Mus* alone he got twenty-seven species. He noted down two hundred species of *Mammiferæ*, and in this number there are hardly five or six, omitting the domestic species, which appear identical with their species in Europe.

With regard to the birds of China, M. David has prepared, with the help of M. G. Masson, a book on them, in which he recognizes 807 species either living in China or coming there regularly. Amongst the greatest novelties he mentions the large *Lophophorus* of Tibet, which lives at a height of above 12,000 feet; the three known *Crossoptilon*, of which one is white another blue, and the third black and white; the *Tragopan*, with a large many-coloured band around the throat, and its head ornamented with two very thin, blue, and fleshy horns; two *Eulophes*, crested pheasants, which are the most appreciated dish by gourmands; the sacred pheasant, with a tail over six feet long; the Amherst pheasant, now become, like the preceding, a common bird in the parks; and a new species of pheasant, dark-coloured, and always living under trees. All these birds, and hundreds of others from the same source, are exhibited in the French Museum. Some of them, according to the method common among naturalists, are named after the discoverer. Thus the *Cygnus davidi*, a very rare swan with red legs, and the *Pterorhinus davidi*, a kind of mocking-bird captured in the woods in the neighbourhood of Pekin; the *Sygrnium davidi*, a nocturnal rapacious bird of Tibet, described by Mr. Sharp, of the British Museum. M. H. Milne-Edwards, Professor at the Sorbonne, has also affixed M. David's name to two new species which he has described, *Carpodacus davidianus* and *Oreopneuste armandi*. China has not our sparrow, chaffinch, goldfinch, or linnet; our warbler, redbreast, and nightingale are unknown; their thrushes, blackbirds, tomtits, and crows, differ very much from ours. In fact, speaking generally, there is only about one-fifth of the Chinese birds found in Europe, and the greater part of these are very different in the two regions. The Eastern *Gallinæ*, *Insectivores*, and *Rapaces*, have scarcely any species like them in our continent. A very remarkable fact is that we find certain groups of birds within certain narrow limits where they are represented by numerous species, whilst they are totally absent from all other parts of the earth, even from those parts where it would be quite possible for them to live. Thus there are forty kinds of the beautiful pheasant class, all grouped around Tibet, while there is not a single member of the class in any other quarter of the globe. So the *Crateropodes*, of which there are thirty or forty species in China, do not appear to have any representatives in Europe. These and other facts furnish M. David with what he considers unanswerable objections to the theory that they were all created *ab origine*. Is it not more reasonable, he asks, to admit that the principal types of plants and animals having once appeared on earth, where and when it pleased Providence, have undergone slow variations which have divided them by degrees into species and varieties? America has upwards of four hundred species of humming-birds, while there is not a single other specimen in the rest of the tropical world, where those little creatures could live equally well. Every class of the animal kingdom, he says, furnishes similar examples and analogous facts.

The subject of reptiles, *Batrachia*, and fishes, which M. David only worked up slightly, has been carefully pursued by M. Duméril, Dr. Savage, and M. E. Blanchard. The last-named gentleman described before the Academy of Sciences, under the name of *Sieboldia davidiana*, an immense salamander which lives on fish and crabs in fresh water. A skeleton of a salamander, more or less resembling this one, has recently been found in Germany, where it was taken for a fossil man. It is the insect world which supplied M. David with the greatest novelties. Great though the collections sent to Europe are, they are but a small fraction of the riches in entomology that China supplies. The Coleoptera have been described by M. Fairmaire, formerly President of the French Entomological Society, and the Lepidoptera by M. Oberthur, of Rennes, who has the finest collection in France, and perhaps in the world. Amongst insects, more even than amongst animals and plants, there is a large number called by the names of the missionaries who sent specimens of them to Europe. For example, *Cicindela desgodinsii*, *Carabus delavayi*, *Cychrus davidi*, *Nebria chaslei*, *Enoplotrupes largeteani*, *Donacia provosti*, &c., in Coleoptera; and in butterflies, *Anthocharis bicti*, *Armandia thaïdina*, &c. With regard to the vegetable kingdom, the first important work we have on the Chinese flora has been finished this year, and styled "Plantæ Davidianæ." It has been printed at the expense of the State, and is in two quarto volumes, illustrated with forty-five very fine plates, and contains a description of all the new species of plants in M. David's collection, and an enumeration of all the plants collected by him. The collection contains a small proportion only of the plants of China. It should only be regarded as a mere skeleton of the magnificent vegetation of the east-central provinces, but it contains the greater portion of the plants to the north of the empire and in the Mongolian mountains. Collections made by English and Russian collectors do not include many of the specimens found by M. David. Perhaps the most remarkable find was the *Davidia involucrata*—a pretty tall tree with large leaves, for the introduction of which an English amateur has offered a big prize. Our European plants are not at all common in the East. No trefoils are found in China, nor heather, nor broom. There are also many plants there which have no representatives in Europe, but which have representatives in America, as, *Pavia*, *Bignonia*, *Aralia*, *Dielytra*. Northern China, with its dry climate, its cold winter, as cold as that of Upsala, and its summer as warm as that of Senegal, has a poor and little-varied vegetation when compared with the centre and west of the empire. The number of Phanerogams collected by M. David in the north of China did not exceed 1500 species, and he doubts if there are many more.

In geography and geology, besides several occasional reports, the "Archives du Muséum" have published full accounts of his first and second journeys of exploration. These voluminous writings are merely journals written for some friends, for whom he wrote day by day everything that seemed worthy of attention, whether botanical, geological, or geographical, in the extensive regions which for five years he travelled over. Itinerary charts, striking altitudes, up to 15,000 feet, the direction and importance of rivers and mountain chains, the position of the lesser known towns and countries, and of the coal and metal mines—all have been noted down by him. From the writings of M. David, M. Elisée Reclus took many of his observations on the Chinese Empire in vol. vii. of this "Géographie Universelle," and especially the natural history portion of that volume. Similarly Baron Richthofen has derived much of the information in his work on geology from M. David. In Mongolia M. David's guide was Sambdatchiemda, the famous ex-lama described by M. Huc, and this leads M. David to speak of the lamas, and tell some stories about them.

M. David describes a curious meteorological phenomenon observed by him when crossing the top of a mountain about 5500 feet high. A storm had just passed, and a little rain had fallen. The clouds were heavy, and lay on the numerous peaks below his feet like an immense sea of silvery white. Little by little the masses of clouds began to move and to split up here and there. They rose slowly and soon came to the right of M. David, who was journeying from south to north. The wind was blowing from the west, and when the clouds reached the summit of the mountain they could not pass over on account of the opposition of the wind, and there they rested, a huge mass of opaque clouds. The sun was setting on the horizon, and threw the image of M. David on the wall of white clouds, where it was surrounded by two rainbows, or rather two complete concentric circles. This phenomenon lasted nearly half an hour. M. David had been six months in Mongolia when the revolt of the Mussulmans broke out and prevented him from penetrating as far as Koukounoor, and even beyond it, as was his intention. These high Mongolian plateaux are of about three thousand feet above the level of the sea. The population is very sparse, and the fauna and flora but little varied. The remarkable animals most frequently seen in this region are the souslik, or yellow antelope, a kind of little marmot analogous to the prairie dog of America, a brownish weevil, and a curious lizard with round head (*Phrynocephalus*) which is seen everywhere rolling its tail in regular cadences. During the summer the open country is covered either with the blue-flowered iris, or with the liquorice (*Glycyrrhiza echinata*) or the yellow rose. M. David found in Mongolia in a wild state, but very rare, a pretty flowering tree, which the Pekinese cultivate as an ornamental plant (*Xanthoceras sorbifolia*), and which he introduced into France with much success. In his journey he satisfied himself of the existence of wild camels, some of which were afterwards captured by the Russian traveller Prjevalski. M. David spent twenty-five months in Western China. He had intended to spend three years, but his health broke down. In that time he travelled over 2500 leagues. He returned thence to Tien-tsin, fortunately for him after the massacres had taken place, his boat having been delayed on the way.

THE AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SYDNEY, *July* 1888.

THE formation of this Association, which already gives promise of being a great success, was first suggested by Prof. Liversidge, of the Sydney University, during the Exhibition in Sydney in 1879, but matters at that time not being considered quite ripe for it, the formation of the Association was again brought forward through the press in the year 1884. It was then suggested that, as it did not seem likely that the British Association would see their way to visit Australia during the Centennial year, an Australasian Association should be formed, on the same lines as the British Association, in order to bring about a federation or union of the members of the various scientific Societies throughout Australasia.

It was also suggested that the first general meeting should be held in Sydney on the one hundredth anniversary of the foundation of the colony, as it was at that time thought there would be an International Exhibition in Sydney to celebrate that event. In furtherance of this object a preliminary meeting of delegates was held in Sydney in November 1886, the project having met with the approbation and support of almost all the learned and scientific Societies of Australasia.

As this meeting the formation of the Australasian Association for the Advancement of Science was agreed to unanimously, the rules of the British Association being adopted until the first general meeting, which it was decided should be held in Sydney during the year 1888.

In accordance with another resolution passed at the meeting of delegates, the election of officers for the year took place in March of the present year, Mr. H. C. Russell, F.R.S., Government Astronomer, being elected President,